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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/790,904

03/02/2004

Jason L. Mitchell

00100.02.0045

2636

29153 7590 03/04/2011
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EXAMINER

BADER, ROBERT N.

ART UNIT

PAPER NUMBER

2628

MAIL DATE

DELIVERY MODE

03/04/2011

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/790,904	Applicant(s) MITCHELL ET AL.	
	Examiner ROBERT BADER	Art Unit 2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 February 2011.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2,3,5,6,11-16,20 and 21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2,3,5,6,11-16,20 and 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to the Applicants' communication filed on 2/15/11. In virtue of this communication, claims 2,3,5,6,11-16,20 and 21 are currently presented in the instant application.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 21, 2, 3, 5, and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 6,259,461 B1 (hereinafter **Brown**).

Regarding claim 21, the limitation "a method for object based visibility culling performed by an apparatus that performs graphics processing" is taught by Brown (col 3, lines 36-56, "The method operates in a computer graphics system having an application program that interfaces through an application program interface (API) to a graphics pipeline, including a rendering pipeline and a frame buffer. The method includes the step of providing a visibility flag that is in communication with the application program to relay rendering information to the application program. The method clears (or resets) the visibility flag upon sending new data to the rendering pipeline, and sets the visibility flag if data sent to the rendering pipeline from the

application program is further communicated to the frame buffer for display. Thereafter, the method evaluates the visibility flag from within the application program after a first pass of a first segment of graphics data has been rendered by the rendering pipeline. If the visibility flag was not set during the first pass, then the application program inhibits the rendering of subsequent passes of the first segment of graphics data. If, however, the visibility flag was set during the first pass, then the application program will send subsequent passes of the graphics data to the rendering pipeline for processing and display.")

The limitation "receiving, by a graphics processing unit, a plurality of draw packets" is taught by Brown (as indicated in the section quoted above, graphics data is broken up into segments, i.e. the first segment, and others)

The limitation "comparing, by the graphics processing unit, each of the plurality of draw packets to a bounding volume object, wherein the bounding volume object is a low resolution geometric representation of a specific object identified as geometry whose visibility status is desired" are taught by Brown (col 7, lines 13-25, "In similar fashion, when an application program 102 is configured to display a graphics scene that requires the rendering of relatively complex (i.e., computationally extensive) graphics shapes or objects, the application program 102 may be segmented by a developer to first send a relatively simplified version of the object or shape to be rendered to the graphics pipeline, and thereafter test the visibility of flag 110. If the visibility flag indicates that no part of the shape was rendered, then the application program 102 may skip over subsequent graphics calls that would further render the shape or object. In this way,

otherwise unnecessary computations may be saved by selective and careful programming at the application program 102 level.")

The limitation "for each of the plurality of draw packets that are deemed potentially visible based on the comparison, electronically rendering, by the graphics processing unit, one or more draw packets deemed potentially visible" is taught by Brown (col 7, lines 13-25, as quoted above, indicate that when a tested object is determined to be completely invisible, it can be ignored from thereon in order to avoid unnecessary computation).

Regarding claim 2, the limitation "prior to rendering the one or more draw packets, providing the plurality of draw packets to a command processor such that the command processor checks for the set visibility query identifier for a draw packet based on the comparison" is taught by Brown (col 7, line 57 - col 8, line 8, "In addition, and in accordance with the teachings of the present invention, each object structure 130, 140, and 150 may include a status value 138 for the visibility flag 110. When, for example, the application program submits a given object for rendering, upon return (from the API) the application program may check the status of the visibility flag 138 within the objects data structure. If the visibility flag is clear, it informs the application program that no portion of the object was visible. If, however, the visibility flag is set, the application program then recognizes that at least a portion of the object was visible. Thus, an application program could utilize an object data structure of this format by rendering on set of the object's primitives, then checking the visibility flag 138. if the flag was set, then the application program could control the rendering o the object to render the

remaining sets of object primitives. Otherwise, the application program could avoid any attempts at rendering the object.")

Regarding claim 3, the limitation "wherein prior to rendering the one or more draw packets the method further includes fetching a plurality of indices for the one or more draw packets based on the visibility query identifier" is taught by Brown (col 7, line 57 - col 8, line 8, as quoted in the claim 2 rejection, indicate that prior to rendering an object or portions of an object, a decision is made based on the visibility query identifier whether the object/portions are to be rendered. As shown in FIG 4, each object, which is rendered based on its associated visibility flag, identifies one or more associated primitives to be rendered, which may correspond to one or more draw packets, depending on how the developer chooses to divide the object geometry. Col 10, lines 11-21, "For example, the foregoing discussion has described the segmentation of a graphics scene into distinct objects for rendering. However, a developer or programmer may choose to segment a graphics scene in any of a variety of ways, consistent with the invention. Thus, rather than subdivide the graphics image into distinct objects, the developer may more generically partition or segment the image into distinct segments, which do not necessarily correlate to objects. Nevertheless, the segmented graphics scene may be processed in a manner similar to that described above in connection with objects.")

Regarding claim 5, the limitation "prior to providing the plurality of draw packets to the command processor, stalling for a predetermined time interval to insure the setting of the visibility query identifier" is taught by Brown (col 10, lines 22-28,

"Furthermore, it will be appreciated that some additional delay or latency is inserted into the operation of the application program as described herein. In this regard, additional time is required for the application to perform a check of the visibility flag, and when further information is to be rendered, initiate the rendering of that further information.")

Regarding claim 6, the limitation "wherein comparing each of the plurality of draw packets to the bounding volume includes at least one of the following: back-face culling, view frustum comparison, user-clip plane discard, and hierarchical-z discard" is taught by Brown (col 5, lines 7-12, "The clipping component 26 clips the vertex data so that only the vertex data relating to primitives that make up the portion of the view that will be seen by the user is kept for further processing. If the vertex data reveals that the entire primitive is outside the viewing window, then all other vertex data may be discarded or ignored." Brown is describing a view frustum comparison.)

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,259,461 B1 (hereinafter **Brown**) as applied to claim 3 above, and further in view of "ARB_occlusion_query" by R. Cuniff, M. Craighead, D. Ginsburg, K. Lefebvre, B. Licea-Kane, and N. Triantos (hereinafter **Cuniff**).

Regarding claim 20, the limitation "further comprising managing a plurality of visibility query identifiers that define which of a plurality of hardware queries is to be updated across multiple driver contexts" is not explicitly taught by Brown (Brown doesn't discuss multiple driver contexts). However, this limitation is taught by Cunniff (page 6, 4th issue, "Are query objects shareable between multiple contexts? RESOLVED: No. Query objects are lightweight and we normally share large data across contexts. Also, being able to share query objects across contexts is not particularly useful." Although not explicitly stated, it is clear that query objects exist separately for hardware queries in multiple contexts, as it is noted they are not able to be shared across contexts.)

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Brown's visibility flag system to allow different contexts to maintain their visibility flag separately from one another, because there is no particular benefit to sharing them (as indicated by Cunniff), and because it is implicit in supporting multiple contexts that if there are multiple driver contexts executing 3D applications which would benefit separately from Brown's visibility flag system, each would still retain a performance advantage with Brown's system when being executed simultaneously as separate driver contexts.

5. Claims 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,259,461 B1 (hereinafter **Brown**) in view of "Designing a PC Game Engine" by L. Bishop, D. Eberly, T. Whitted, M. Finch, and M. Shantz (hereinafter **Bishop**).

Regarding claim 11, the limitations "an apparatus for object based visibility culling, the apparatus comprising: a graphics processing unit; and a memory device storing executable instructions such that the graphics processing unit, in response to the executable instructions" is taught by Brown (col 3, lines 36-56, as quoted in the claim 21 rejection, indicate that a graphics pipeline used to process graphics data performs object based visibility culling. It is implicit that the application program is stored in some memory device.)

The limitation "receives a plurality of draw packets" is taught by Brown (as indicated in col 3, lines 36-56, as quoted in the claim 21 rejection, graphics data is broken up into segments, i.e. the first segment, and others).

The limitation "compares each of the plurality of draw packets to a bounding volume object, wherein the bounding volume is a low resolution geometric representation of a specific object" is taught by Brown(col 7, lines 13-25, "In similar fashion, when an application program 102 is configured to display a graphics scene that requires the rendering of relatively complex (i.e., computationally extensive) graphics shapes or objects, the application program 102 may be segmented by a developer to first send a relatively simplified version of the object or shape to be rendered to the graphics pipeline, and thereafter test the visibility of flag 110. If the visibility flag indicates that no part of the shape was rendered, then the application program 102 may skip over subsequent graphics calls that would further render the shape or object. In this way, otherwise unnecessary computations may be saved by selective and careful programming at the application program 102 level.")

The limitation "a low resolution geometric representation of a specific object identified as geometry through which viewing definitions are defined" is partially taught by Brown (Brown teaches making visibility determinations using low resolution geometric representations, teaching that all objects may benefit from such a simplification, rather than just "a specific object identified as geometry through which viewing definitions are defined".) However, this limitation is taught by Bishop (section "Interiors and portals", paragraph 2, "Portals draw themselves by adding a clipping plane to the camera for each edge of the portal polygon. These planes are each defined by a portal polygon edge and the camera center. Thus, each portal adds a new frustum to the set of culling/clipping planes, as shown in Figure 5. Having pushed the new clipping planes, the portal draws its adjoiner and then removes the clipping planes it added to the camera. Geometry in a portal's adjoiner is thus culled and clipped to the portal.")

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Brown's visibility flag system to execute an application program using Bishop's portals, using Brown's object simplification technique to reduce the computational cost of using Bishop's portals (thus making a bounding volume object which is "a low resolution geometric representation of a specific object identified as geometry through which viewing definitions are defined").

The limitation "for each of the plurality of draw packets, if the draw packet is deemed potentially visible, sets a visibility query identifier for the draw packet" is taught by Brown (col 7, line 57 - col 8, line 8, as quoted in the claim 2 rejection, indicate that

prior to rendering an object or portions of an object, a decision is made based on the visibility query identifier whether the object/portions are to be rendered, based on a status value associated with that object or portion of object. Col 10, lines 11-21, as quoted in the claim 3 rejection, indicate that although discussion is made in reference to objects, any subdivision preferred by an application programmer may be used, which could include every draw packet, if desired.)

The limitation "using at least one of a plurality of identifiers that defines which of a plurality of hardware queries is to be updated" is taught by Brown (col 7, line 57 - col 8, line 8, as quoted in the claim 2 rejection, indicate that each object (or draw packet, as discussed above) is associated with a query.)

The limitation "renders one or more draw packets having the set visibility query identifier" is taught by Brown (col 7, lines 13-25, as quoted above, indicate that when a tested object is determined to be completely invisible, it can be ignored from thereon in order to avoid unnecessary computation).

Regarding claim 12, the limitations are similar to those treated in the above rejection(s) and are met by the references as discussed in claim 2 above.

Regarding claim 13, the limitations are similar to those treated in the above rejection(s) and are met by the references as discussed in claim 3 above.

Regarding claim 14, the limitation "when the visibility query identifier is not set, indicating that a particular draw packet is not visible, the command processor discards the draw packet" is taught by Brown (col 7, lines 13-25, as quoted in the claim 11 rejection, indicate that when a tested object is determined to be completely invisible, it

can be ignored from thereon in order to avoid unnecessary computation. This is considered to be a discard.)

Regarding claim 15, the limitations are similar to those treated in the above rejection(s) and are met by the references as discussed in claim 5 above.

Regarding claim 16, the limitations are similar to those treated in the above rejection(s) and are met by the references as discussed in claim 6 above.

Response to Arguments

6. Applicant's arguments filed 2/15/11 have been fully considered but they are not persuasive.

Applicant asserts, on the basis of citing col 6, lines 50-57 of Brown, that the visibility flag of Brown is only set after sensing communication of data from the rendering pipeline to the frame buffer, and as a result, Brown cannot read on Applicant's claim. Applicant's citation disputes Applicant's assertion, in stating "Alternatively, the mechanism 112 may be controlled directly from the rendering pipeline 106 itself, to set and clear the status of the visibility flag." As Applicant's assertion is based only on the reading of the citation discussed by Applicant, and Brown explicitly indicates that there is an alternate way to control the visibility flag, this assertion, and depending argument that Brown's visibility flag requires data to be written to the frame buffer, is not persuasive.

Applicant argues that col 7, lines 13-25 "actually refers to an object that is determined to be "completely invisible", and that in contrast, the claim requires visibility

indication wherein the draw packet is deemed potentially visible. The citation Applicant refers to actually states "**If** the visibility flag indicates that no part of the shape was rendered...". The flag is used to indicate if a given object or portion of object is determined to be visible, and Brown is merely noting the readily apparent fact that in the case of an object which is determined to not be visible, no further effort should be directed to rendering said invisible object. Brown is not suggesting, as Applicant implies, that the visibility flag may only be used to determine invisibility. Therefore, this argument is not persuasive.

Applicant additionally argues with reference to the above citation that "no packet level determination appears to be done", however, as discussed in rejections of claims 21 and 3 above, and the 9/30/10 Office Action, Brown's "segments" correspond to Applicant's "packets", which can represent any object segmentation scheme desired by a developer. Therefore, this argument is not persuasive.

Applicant argues that independent claim 11 and claims depending on claims 11 and 21 are allowable for the same reasons as claim 21, however, those arguments are still not persuasive.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT BADER whose telephone number is (571)270-3335. The examiner can normally be reached on M-T 9am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ROBERT BADER

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Examiner
Art Unit 2628

/Ulka Chauhan/
Supervisory Patent Examiner, Art Unit 2628